

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1-8. (Cancelled)

9. (Currently amended) A method of moving a fine stage device, the method comprising:

connecting a fine stage device to a coarse stage device, the coarse stage device comprising an attracting framework comprising opposing attracting members and at least one target member, wherein the target member is located in a gap between the attracting members and connected to the fine stage device; and

manipulating the relative position of the target member with respect to the attracting members by an actuator coupled between the coarse stage device and the fine stage device so as to decrease the distance between one of the attracting members and the target member during a coarse stage adjustment phase, wherein the actuator is capable of directly moving the fine stage device relative to the coarse stage device.

10. (Original) The method of claim 9, wherein at least one of the attracting members comprises a core member and a coil assembly that is disposed near the core member, and the method further comprises:

providing a current to the coil assembly to cause acceleration movement of the fine stage device.

11. (Original) The method of claim 9, wherein at least one of the attracting members comprises a core member and a coil assembly that is disposed near the core member, and the method further comprises:

providing a current to the coil assembly to cause deceleration movement of the fine stage device.

12. (Currently amended) A dual-force-mode fine stage apparatus comprising:

a first assembly including a target member;

a second assembly including a first attracting member and a second attracting member located on opposite sides of the target member; and

an actuator associated with the first assembly, wherein the actuator is capable of directly moving ~~moves~~ the first assembly to adjust a relative distance between the target member and the first attracting member;

wherein, before an acceleration phase, the actuator adjusts a gap size between the target member and an attracting member that provides acceleration during the acceleration phase by moving at least one of the first attracting member and the second attracting member relative to the target member, and during a constant velocity phase, the actuator changes a gap size between the target member and an attracting member that provides deceleration during a deceleration phase by moving at least one of the first attracting member and the second attracting member relative to the target member.

13. (Currently amended) A dual-force-mode stage assembly comprising:

a fine stage assembly;

a coarse stage assembly, the coarse stage assembly comprising

opposing attracting members, each capable of drawing an electric current, with a gap between the attracting member elements; and

a target member in the gap, the target member being connected to the fine stage assembly,

wherein the coarse stage assembly is moveable along an axis independently of the fine stage assembly through a fine stage actuator, wherein the fine stage actuator is capable of directly moving the fine stage assembly relative to the coarse stage assembly;

a sensor configured to detect a position of the target member so that the relative distance between the target member and the attracting members can be determined;

and

a controller coupled to the fine stage actuator to control the distance between the target member and the attracting members;

wherein the controller is adapted to change gap size between the target member and one or more attracting members that provide an acceleration force and/or a deceleration force to the target member during an acceleration and/or deceleration phase by moving the coarse stage assembly relative to the fine stage assembly during a constant velocity phase followed by the acceleration and/or deceleration phase.

14. (Previously Presented) A stage device comprising:

a table that retains an object;

a first attracting member opposing a second attracting member;

at least one target member situated between the first attracting member and the second attracting member, wherein the table is attached to at least one of the first attracting member, the second attracting member, and the target member;

at least one actuator associated with the target member to adjust the distance between the target member and at least one of the first and second attracting members, wherein the at least one actuator is capable of directly moving the target member relative to the attracting members;

at least one sensor that detects a gap between the target member and at least one of the first and second attracting members; and

a controller coupled to the actuator to adjust the size of the gap between the target member and at least one of the first and second attracting members;

wherein the controller is adapted to change gap size between the target member and one or more attracting members that provide an acceleration force and/or a deceleration force to the target member during an acceleration and/or deceleration phase by moving at least one of the first attracting member and the second attracting member relative to the target member during a constant velocity phase followed by the acceleration and/or deceleration phase.

15. (Currently amended) An exposure apparatus comprising:

an illumination system that irradiates radiant energy; and

a stage device that carries an object disposed on a path of the radiant energy, wherein the stage device comprises:

a table that retains the object;

a first attracting member opposing a second attracting member;

at least one target member situated between the first attracting member and the second attracting member, wherein the table is attached to at least one of the first attracting member, the second attracting member, and the target member;

at least one actuator to adjust the distance between the target member and at least one of the first and second attracting members, wherein the at least one actuator is capable of directly moving the target member relative to the attracting members;

at least one sensor that detects a gap between the target member and at least one of the first and second attracting members; and

a controller coupled to the actuator to adjust the size of the gap between the target member and at least one of the first and second attracting members;

wherein the controller is adapted to change gap size between the target member and one or more attracting members that provide an acceleration force and/or a deceleration force to the target member during an acceleration and/or deceleration phase by moving at least one of the first attracting member and the second attracting member relative to the target member during a constant velocity phase followed by the acceleration and/or deceleration phase.

16. (Original) The exposure apparatus of claim 15, wherein the object comprises a wafer or a reticle.

17. (Currently amended) A method for operating an exposure apparatus, the method comprising employing a stage device to position an object, wherein the stage device comprises:

- a table that retains the object;

- a first attracting member opposing a second attracting member;

- at least one target member situated between the first attracting member and the second attracting member, wherein the table is attached to at least one of the first attracting member, the second attracting member, and the target member;

- at least one actuator associated with the target member to adjust the distance between the target member and at least one of the first and second attracting members, wherein the at least one actuator is capable of directly moving the target member relative to the attracting members;

- at least one sensor that detects a gap between the target member and at least one of the first and second attracting members; and

- a controller coupled to the actuator to adjust the size of the gap between the target member and at least one of the first and second attracting members;

- wherein the controller is adapted to change gap size between the target member and one or more attracting members that provide an acceleration force and/or a deceleration force to the target member during an acceleration and/or deceleration phase by moving at least one of the first attracting member and the second attracting member relative to the target member during a constant velocity phase followed by the acceleration and/or deceleration phase.

18. (Original) The method of claim 17, wherein the object comprises a wafer or a reticle.

19. (Currently amended) A method for making a micro-device, the method comprising a photolithography process using a stage device to position an object, wherein the stage device comprises:

- a table that retains the object;

- a first attracting member opposing a second attracting member;

- at least one target member situated between the first attracting member and the second attracting member, wherein the table is attached to at least one of the first attracting member, the second attracting member, and the target member;

- at least one actuator associated with the target member to adjust the distance between the target member and at least one of the first and second attracting members, wherein the at least one actuator is capable of directly moving the target member relative to the attracting members;

- at least one sensor that detects a gap between the target member and at least one of the first and second attracting members; and

- a controller coupled to the actuator to adjust the size of the gap between the target member and at least one of the first and second attracting members;

- wherein the controller is adapted to change gap size between the target member and one or more attracting members that provide an acceleration force and/or a deceleration force to the target member during an acceleration and/or deceleration phase by moving at least one of the first attracting member and the second attracting

member relative to the target member during a constant velocity phase followed by the acceleration and/or deceleration phase.

20. (Original) The method of claim 19, wherein the object comprises a wafer or a reticle.

21. (Currently amended) A method for making a semiconductor device on a wafer, the method comprising operating an exposure apparatus via a stage device to position an object, wherein the stage device comprises:

- a table that retains the object;

- a first attracting member opposing a second attracting member;

- at least one target member situated between the first attracting member and the second attracting member, wherein the table is attached to at least one of the first attracting member, the second attracting member, and the target member;

- at least one actuator associated with the target member to adjust the distance between the target member and at least one of the first and second attracting members, wherein the at least one actuator is capable of directly moving the target member relative to the attracting members;

- at least one sensor that detects a gap between the target member and at least one of the first and second attracting members; and

- a controller coupled to the actuator to adjust the size of the gap between the target member and at least one of the first and second attracting members;

- wherein the controller is adapted to change gap size between the target member and one or more attracting members that provide an acceleration force and/or a

deceleration force to the target member during an acceleration and/or deceleration phase by moving at least one of the first attracting member and the second attracting member relative to the target member during a constant velocity phase followed by the acceleration and/or deceleration phase.

22. (Original) The method of claim 21, wherein the object comprises a wafer or a reticle.

23. (Original) The method of claim 21, wherein the table comprises a wafer stage or a reticle stage.

24. (Currently amended) An apparatus comprising:

an attracting assembly including a first attracting member and a second attracting member opposing to the first attracting member, each of the attracting members generating attracting force;

a target assembly including a target member situated between the first attracting member and the second attracting member;

an actuator provided between the attracting assembly and the target assembly to change a relative position between the attracting assembly and the target assembly, wherein the actuator is capable of directly moving the target assembly relative to the attracting assembly; and

a controller coupled to the actuator, wherein the controller controls the actuator to change gap distances between the target member and the first and second attracting members during an intermission of generating the attracting force.

25. (Previously Presented) The apparatus of claim 24, wherein the controller controls the gap distance based on a direction of the resultant attracting force generated by the first and second attracting members after the intermission.

26. (Previously Presented) The apparatus of claim 25, wherein the controller controls the actuator to position the target member nearer to one of the first and the second attracting members that generates a bigger attracting force than the other one.

27. (Previously Presented) The apparatus of claim 24 comprising:

a sensor connected to the controller, wherein the sensor detects at least one of the gap distances between the target member and the first and second attracting members, and

wherein the controller controls the actuator based on a signal including information of the gap distance from the sensor.

28. (Previously Presented) The apparatus of claim 24, wherein the first and second attracting members comprise a core member and a coil wound around at least a portion of the core member, and the target member comprises a magnetic material.

29. (Previously Presented) The apparatus of claim 24, wherein the actuator comprises a voice coil motor.

30. (Previously Presented) A stage device using the apparatus of claim 24 comprising:

a fine stage that holds an object to be positioned, wherein the fine stage is connected to the target assembly; and

a coarse stage moving with the fine stage, wherein the coarse stage is connected to the attracting assembly.

31. (Previously Presented) The stage device of claim 30, wherein the fine stage is accelerated when the attracting force is generated by at least one of the attracting members, and moves at a constant velocity during the intermission of generating the attracting force.

32. (Currently amended) An apparatus comprising:

an attracting assembly including a first attracting member and a second attracting member opposing to the first attracting member, wherein each of the attracting members generate attracting force;

a target assembly including a target member situated between the first attracting member and the second attracting member;

an actuator provided between the attracting assembly and the target assembly to change a relative position between the attracting assembly and the target assembly, wherein the actuator is capable of directly moving the target assembly relative to the attracting assembly; and

a controller coupled to the actuator to change gap distances between the target member and the first and second attracting members in accordance with the direction of a resultant attracting force generated by the first and second attracting members.

33. (Previously Presented) The apparatus of claim 32, wherein the controller changes the gap distance during an intermission of generating the attracting force.

34. (Previously Presented) The apparatus of claim 32, wherein the controller controls the actuator to position the target member nearer to one of the first and the second attracting members that generates a bigger attracting force than the other one.

35. (Previously Presented) The apparatus of claim 32 comprising:

a sensor connected to the controller, wherein the sensor detects at least one of the gap distances between the target member and the attracting members, and

wherein the controller controls the actuator based on a signal including the gap distance information from the sensor.

36. (Previously Presented) The apparatus of claim 32, wherein the first and second attracting members comprise a core member and a coil wound around at least a portion of the core member, and the target member comprises a magnetic material.

37. (Previously Presented) The apparatus of claim 32, wherein the actuator comprises a voice coil motor.

38. (Previously Presented) A stage device using the apparatus of claim 32 comprising:

a fine stage that holds an object to be positioned, wherein the fine stage is connected to the target assembly; and

a coarse stage moving with the fine stage, wherein the coarse stage is connected to the attracting assembly.

39. (Previously Presented) The stage device of claim 38, wherein the fine stage is accelerated when the attracting force is generated by the attracting members, and moves at a constant velocity during an intermission of generating the attracting force.

40. (Currently amended) A method of moving a fine stage coupled to a coarse stage by an electromagnetic device, wherein the electromagnetic device includes a first attracting member, a second attracting member, and a target member situated between the first attracting member and the second attracting member, wherein the target member is connected to the fine stage and the first and second attracting members are connected to the coarse stage, the method comprising:

accelerating the fine stage by a first attracting force generated in a first gap between the target member and the first attracting member with a first distance;

changing a position of the target member with respect to the first and the second attracting members when the fine stage is moving at a constant velocity by an actuator

coupled between the coarse stage and the fine stage, wherein the actuator is capable of directly moving the target member relative to the attracting members; and

decelerating the fine stage by a second attracting force generated in a second gap between the target member and the second attracting member with a second distance.

41. (Previously Presented) The method of claim 40, wherein the electromagnetic device does not generate the attracting force during changing the position of the target member.

42. (Previously Presented) The method of claim 40, wherein the position of the target member is changed from a first position where the first gap has the first distance to a second position where the second gap has the second distance when the fine stage is moving at a constant velocity.

43. (Previously Presented) The method of claim 42, wherein the first position is where the target member is positioned nearer to the first attracting member than the second attracting member, and the second position is where the target member is positioned nearer to the second attracting member than the first attracting member.